

Early Numeracy Matters!

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For the powerpoint of this presentation, and many basic fact and early diagnosis/intervention resources, go to <https://sites.google.com/site/factswise/>

"[Number sense] is an awareness and understanding about what numbers are, their relationships, their magnitude, the relative effect of operating on numbers, including the use of mental mathematics and estimation." (Fennel & Landis, 1994, p. 187).

New Zealand Numeracy Project at www.nzmaths.co.nz Strategy Stage

E	→	Emergent
CA	→	Counting All (One-to-one Counting, Counting from One on Materials or by Imaging)
AC	→	Advanced Counting
EA	→	Early Additive Part-Whole
AA	→	Advanced Additive–Early Multiplicative Part-Whole
AM	→	Advanced Multiplicative–Early Proportional Part-Whole
AP	→	Advanced Proportional Part-Whole

7th grade students who studied at schools implementing the New Zealand Numeracy Project assessments and activities ("Longitudinal Study" group) compared with New Zealand reference group (Grade 8):

"While the higher scoring students in the two groups were performing at similar levels, a smaller proportion of the longitudinal study students received low scores on the test." (Thomas & Tagg, 2009)

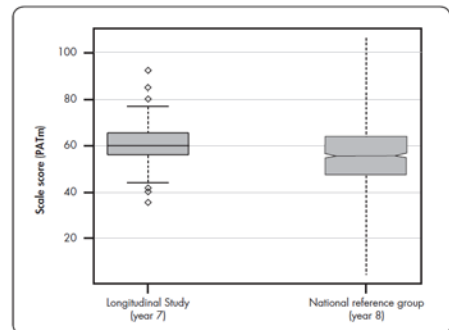


Figure 3. Comparison performance of students on PAT: Mathematics Test 4

Name: _____		Grade: E
EMERGENT		Date Achieved: _____
I am learning to ...		I can ...
• Track and Count	a set of objects 1 2 3 4 5	
• Set	a set of objects, like six books 1, 2, 3, 4, 5, 6	
KNOWLEDGE		
• Read	Numbers up to 10 2 Two 7 Seven	
• Count	Forwards up to 10 1, 2, 3, 4, 5 ...	
• Say	The number after a number (to 5) 3, 4, 5, ...	
• Count	Backwards from numbers up to 10 9, 8, 7 ...	
• Say	The number before a number (to 5) ... 2, 3, 4	
• Order	Numbers up to 5 2, 3, 5	

Adapted from New Zealand Maths Numeracy Project (<http://www.nzmaths.co.nz/numeracy/>)

Name: _____		Grade: E
COUNTING ALL 1 (One-to-One Counting)		Date Achieved: _____
I am learning to ...		I can ...
• Count	Groups of objects together Groups of objects together	
• Split	A number of objects into groups A number of objects into groups	
KNOWLEDGE		
• Read	Numbers up to 30 3 Three 9 Nine	
• Count	Forwards up to 30 1, 2, 3, 4, 5 ...	
• Say	The number after a number (to 10) 4, 5, 6, ...	
• Count	Backwards from numbers up to 20 10, 9, 8, 7 ...	
• Say	The number before a number (to 10) ... 3, 4, 5	
• Order	Numbers up to 10 1, 2, 4, 7, 8	
• Know	Patterns to 5 Patterns to 5	

Adapted from New Zealand Maths Numeracy Project (<http://www.nzmaths.co.nz/numeracy/>)

FactsWise: Developing Addition and Subtraction Fluency and Flexibility

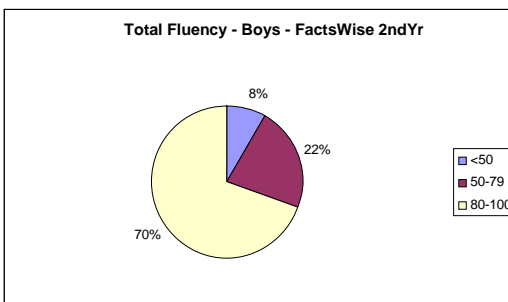
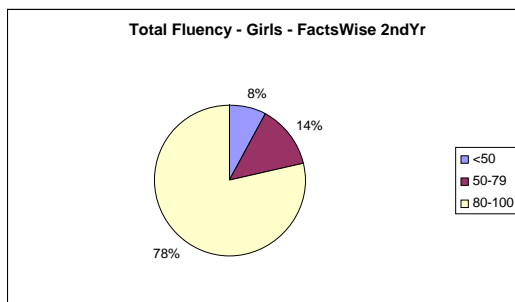
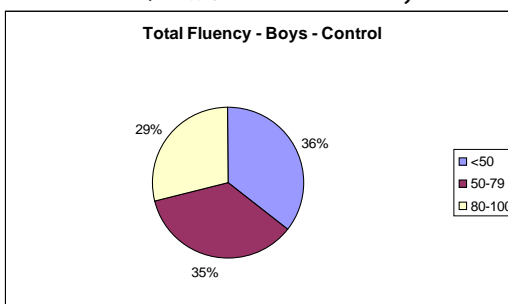
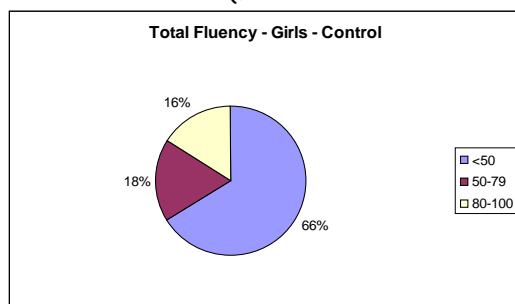
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FactsWise breaks the facts up into 9 small chunks, with an early focus on 5s and 10s. Consistent with the ways students from many other countries are taught their facts, students are then taught part-whole strategies using 5s and 10s to solve larger facts, including:

$$\begin{array}{c} 8 + 5 \\ \swarrow \searrow \\ 8 + 2 + 3 \\ \swarrow \searrow \\ 10 + 3 = 13 \end{array} \quad \text{or} \quad \begin{array}{c} 15 - 8 \\ \swarrow \searrow \\ 5 + 10 - 8 \\ \swarrow \searrow \\ 5 + 2 = 7 \end{array} \quad \text{or} \quad \begin{array}{r} 15 \\ - 8 \\ \hline \end{array} \rightarrow \begin{array}{r} 10 + 5 \\ - 8 \\ \hline 2 + 5 = 7 \end{array}$$

Percent of Students Demonstrating Basic Facts Fluency

Solving 10 addition and 8 subtraction facts without counting in 3 seconds or less
(98 control students and 141 FactsWise students from Decile 10 Schools)



Yellow - 80-100% fluent; Red - 50-79% fluent; Blue - less than 50% fluent

RESEARCH-BASED PRINCIPLES FOR BUILDING BASIC FACTS FLUENCY

1. Focus on accuracy, fluency, and part-whole thinking
 - Encourage students to move from counting to strategies as well as memorization
2. Teach new material in a hierarchical order
3. Teach subtraction/division facts just after related addition/multiplication facts
4. Ongoing whole-class instruction & practice (every 24-48 hours)
 - Elaborative Rehearsal
 - Immediate Feedback
5. Ongoing one-on-one assessment
 - Continuing press to move beyond counting
6. Systematic homework

NINE GOALS FOR BASIC FACTS SUCCESS

Goal 1 - Within 4s & 5s $1+3, 2+2, 3+1, 1+4, 2+3, 3+2, 4+1$ $4-1, 4-2, 4-3, 5-1, 5-2, 5-3, 5-4$	Goal 5 - With 5s (part 2) $5+6, 5+7, 5+8, 5+9$ $11-5, 11-6, 12-5, 12-7, 13-5, 13-8, 14-5, 14-9$
Goal 2 - With 5s (part 1) $1+5, 2+5, 3+5, 4+5, 5+5$ $6-1, 6-5, 7-2, 7-5, 8-3, 8-5, 9-4, 9-5, 10-5$	Goal 6 - Doubles $3+3, 4+4, 6+6, 7+7, 8+8, 9+9$ $6-3, 8-4, 12-6, 14-7, 16-8, 18-9$
Goal 3 - Within 10s $0+10, 1+9, 2+8, 3+7, 4+6$ $10-0, 10-10, 10-1, 10-9, 10-2, 10-8, 10-3, 10-7, 10-4, 10-6$	Goal 7 - Under Tens $2+4, 2+6, 2+7, 3+4, 3+6$ $6-2, 6-4, 8-2, 8-6, 9-2, 9-7, 7-3, 7-4, 9-3, 9-6$
Goal 4 - With 10s $10+1, 10+2, \dots 10+9, 10+10$ $11-1, 11-10, \dots 18-8, 18-10, 19-9, 19-10, 20-10$	Goal 8 - With 9s $2+9, 3+9, 4+9, 6+9, 7+9, 8+9$ $11-2, 11-9, 12-3, 12-9, 13-4, 13-9, 15-6, 15-9, 16-7, 16-9, 17-8, 17-9$
Goal 9 - With 7s & 8s $4+7, 6+7, 3+8, 4+8, 6+8, 7+8$ $11-4, 11-7, 13-6, 13-7, 11-3, 11-8, 12-4, 12-8, 14-6, 14-8, 15-7, 15-8$	

Whole-Class Routines - Goal 1 - Ways to make 4 and 5

Concrete Routines

- 1) **Show Me** - have students, on one hand, show 1, 2, 3, 4, 5. Do this routine for 1 or 2 minutes per day until they are able to do this automatically.
- 2) **Abacus Show Me** - have some students show 1, 2, 3, 4, 5 on the abacus while others show on one hand.
- 3) **All the Ways** - have 4 students stand in front of the class on the right side of the room - this represents $4=0+4$. Have one student at a time walk to the left side of the room. Have the students in the class choral chant $4=1+3, 4=2+2, 4=3+1, 4=4+0$. Use this same procedure for ways to make 5.
- 4) **One Hand Choral** - have students use one hand to model addition problems first ($1+3$ makes, $2+3$ makes, ...). As students become fluent with the addition facts, have students use one hand to model subtraction problems ($4-1$ makes, $4-3$ makes, $5-2$ makes, ...).
- 5) **Snap Cube Student Leaders** - have one or more students use snap cubes (unifix, multilink, ...) to model ways to make 4 and 5 and lead students in choral responses such as " $4+1$ makes" and " $5-4$ makes".

Representational Routines

- 7) **Ten Frame Choral** - show students ways to make 4 and 5 on ten-frame cards and use choral response - " $1+3$ makes" (http://www.wsd1.org/pc_math/Dot%20Card%20and%20Ten%20Frame%20Package2005.pdf).
- 8) **Part-Whole Grid Choral** - show students a part-whole grid for a way to make 4 or 5 and have students state both the addition and subtraction relationships while you write them on the board.

Abstract Routines

- 9) **Snap Facts** - Say a fact such as " $2+3$ makes" and then use a hand signal for wait. Give students 2 or 3 seconds to process, and then snap your fingers, at which time students will choral respond with the answer. Watch carefully for facts where some students are delaying their answers, and repeat those several times before you end the activity. Remember to spend more time on subtraction facts than you do on addition facts!

Arrow Cards

1		8		9	
2		1	0		
3		2	0		
4		3	0		
5		4	0		
6		5	0		
7		6	0		

Goal 5 (with 5s part 2) - Hands Together Game

Math Skills:

- Seeing 10s in the "With 5s (part two)" facts

Materials:

- [Goal 5 Hands Together Cards](#) (p. 81-84)
- [Two Hundreds Chart](#) (p. 22-23)
- 2 counters per player (different colors for each player)

Directions:

1. Place one of the 5 cards face up in the center of the table.
2. The remainder of the cards are shuffled and placed in a face-down draw pile in the center of the table.
3. On each student's turn, the student draws a card from the draw pile and places the card next to the face-up 5 card.
4. The student states the problem and the sum (e.g., " $5 + 7 = 12$ ").
5. The student then moves her/his marker that number of squares on the Two Hundreds Chart. (The first marker can be used to remind a student of her/his starting point until the second marker is correctly placed.)
6. The first player to reach 200 (or beyond) wins the game.
7. Note: As students become confident with these sums, they can be encouraged to move from counting on to moving a 10 and the remaining quantity on the gameboard.

Subtraction Race to 100

Number of players: 2 or more

Math Skills: Subtraction facts fluency (any goal)

Materials: Subtraction Goal Cards (for any goal) - should have at least 10 cards per player
[Hundreds Chart](#) (p. 19)
2 markers for each player

Directions: All cards are shuffled and placed face down in the center of the table to make a draw pile. On each student's turn, the student draws a card from the draw pile. The student states the problem and the difference (e.g., " $12 - 3 = 9$ "). The student then moves her/his marker that number of squares on the Hundreds Chart. (The first marker can be used to remind a student of her/his starting point until the second marker is correctly placed.) The first player to reach 100 wins the game.

Subtraction War

Number of players: 2 or more

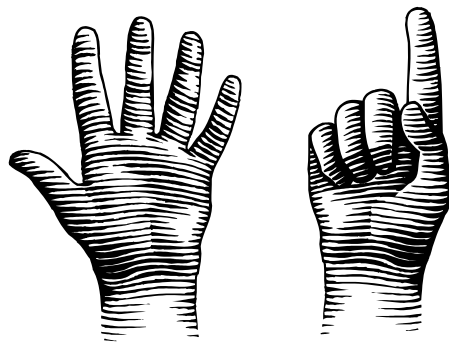
Math Skills: Subtraction facts fluency (any goal)

Materials: Subtraction Goal Cards (for any goal) - should have at least 10 cards per player Goal 9 Big

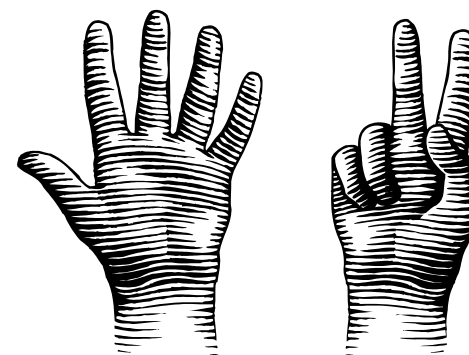
Directions: Deal out all cards equally, face down. For each turn, each player turns over the top card of her or his deck, finds the difference, and then announces the problem and the total (e.g., $15 - 5 = 10$). The player with the highest difference wins all of the cards from that turn from all the students. If there is a tie, a second round is played between those involved in the tie, and the winner of that second round wins all the cards from both rounds.



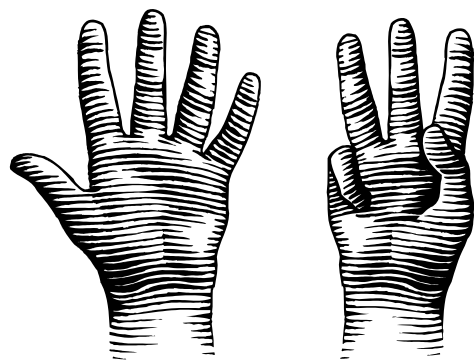
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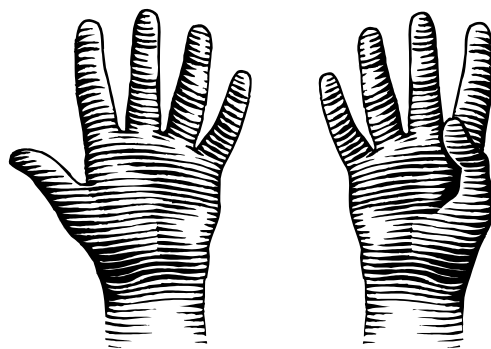
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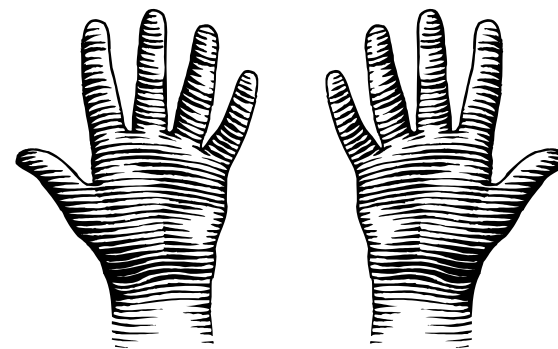
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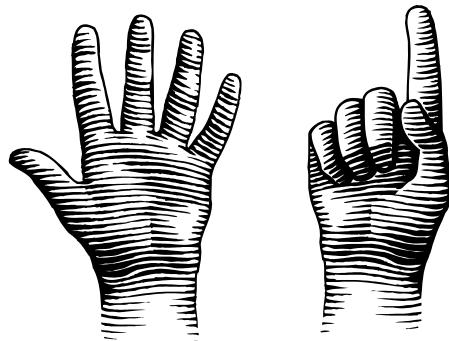
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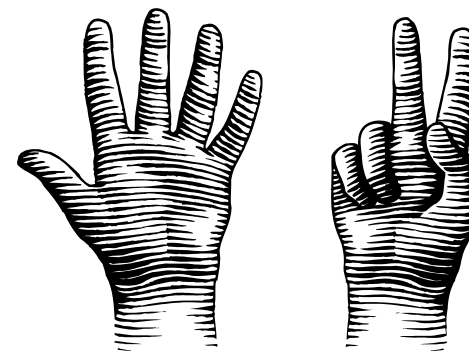
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5



6



7

10-1

10-2

10-3

10-4

10-5

10-6

10-7

10-8

10-9

$5 - 4 = \overline{1}$	$4 - 3 = \overline{1}$	$5 - 3 = \overline{2}$	$5 - 1 = \overline{4}$
$4 - 1 = \overline{3}$	$5 - 2 = \overline{3}$	$5 - 4 = \overline{1}$	$4 - 2 = \overline{2}$
$5 - 3 = \overline{2}$	$4 - 2 = \overline{2}$	$5 - 1 = \overline{4}$	$4 - 3 = \overline{1}$
$1 + 4 = \overline{5}$	$3 + 2 = \overline{5}$	$1 + 3 = \overline{4}$	$2 + 2 = \overline{4}$
$2 + 2 = \overline{4}$	$4 + 1 = \overline{5}$	$3 + 1 = \overline{4}$	$2 + 3 = \overline{5}$

GOAL 1 +/- PAIRS PRACTICE - ANSWER KEY

GOAL 1 +/- PAIRS PRACTICE

Keep practicing these problems until they are "second nature". Time to Beat - 60 seconds!

$2 + 2$	$4 + 1$	$3 + 1$	$2 + 3$
$1 + 4$	$3 + 2$	$1 + 3$	$2 + 2$
$5 - 3$	$4 - 2$	$5 - 1$	$4 - 3$
$4 - 1$	$5 - 2$	$5 - 4$	$4 - 2$
$5 - 4$	$4 - 3$	$5 - 3$	$5 - 1$

$8 - 5 = 3$

$6 - 5 = 1$

$9 - 4 = 5$

$5 - 0 = 5$

$10 - 5 = 5$

$9 - 4 = 5$

$5 - 5 = 0$

$7 - 2 = 5$

$9 - 5 = 4$

$6 - 1 = 5$

$7 - 5 = 2$

$8 - 3 = 5$

$5 + 5 = 10$

$5 + 2 = 7$

$3 + 5 = 8$

$5 + 4 = 9$

$2 + 5 = 7$

$1 + 5 = 6$

$4 + 5 = 9$

$5 + 3 = 8$

GOAL 2 +/- PAIRS PRACTICE - ANSWER KEY

GOAL 2 +/- PAIRS PRACTICE

Keep practicing these problems until they are "second nature". Time to Beat - 60 seconds!

$2 + 5$

$1 + 5$

$4 + 5$

$5 + 3$

$5 + 5$

$5 + 2$

$3 + 5$

$5 + 4$

$9 - 5$

$6 - 1$

$7 - 5$

$8 - 3$

$10 - 5$

$9 - 4$

$5 - 5$

$7 - 2$

$8 - 5$

$6 - 5$

$9 - 4$

$5 - 0$